AN INSTRUMENT FOR DESCRIBING MATHEMATICAL CURVES.

BY F. N. MASSA.

In the SCIENTIFIC AMERICAN SUPPLEMENT No. 1302 will be found a description of an apparatus called by its inventor, Father Deshevrens, a "campylograph," which is designed for drawing every imaginable geometrical figure, as well as simple and complicated algebraic curves. I have designed a somewhat similar instrument based on like general principles, but very different in construction. Of the two photographs herewith reproduced, the one is a plan view and the other a perspective view of my campylograph. Broadly speaking, the apparatus may be described as a train of wheels by which two guide wheels and two paper-bearing disks are rotated.

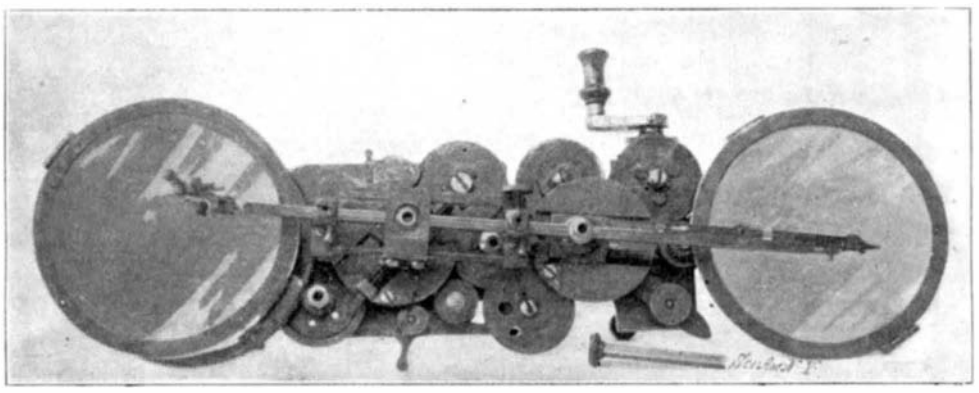
Although the pictures herewith reproduced are not lettered, their details are so clear that the various wheels may be designated by imaginary letters for the sake of easy reference. When paired wheels are mentioned, the letter indicating the upper wheel comes first and the large or small letter indicates the larger or smaller wheel of such pair.

Three wheels are in line centrally from right to left, which may be designated by the letters *A*, *B*, *C*. The wheels *A* and *B* are never in direct gear. The wheel *C* is mounted on a sliding plate and may or may not mesh with the wheel *B*. The wheel *A* is operatively connected with the wheel *B* by either of two pairs of wheels mounted on the arms of a forked lever, turning on the axis of the wheel *A*. One wheel of each pair is always in mesh with the wheel *A*. When the pair nearest the operator is thrown into mesh with the wheel *B*, that wheel turns at half the speed of the wheel *A*. This pair of wheels may be designated by the letters *D*, *d*. When the other pair, which may be designated *E*, *e*, is thrown in mesh with the wheel *B*, that wheel has twice the speed of the wheel *A*. When the wheel *C* carried on the sliding plate is thrown into gear directly with the wheel *B*, the speed of the two is equal. In these cases the direction of rotation of the wheels *A*, *C* is contrary. They may, however, be made to turn in the same direction by reversing wheels, one of which is always in mesh with the wheel *B*. This wheel, which is always connected with the wheel *B*, may connect the wheel *d* with the wheel *B*, or, when the wheel *C* is slid away, it may connect the wheels *B* and *C* with each other. Opposite the wheel *B* is another pair of wheels, mounted on an eccentric axis or stud, with a considerable latitude of motion for position. This pair of wheels, which may be designated as *F*, *f*, may connect the wheel *B* with the wheel *C*, or the wheel *B* with the other reverser, which is thereupon set into gear with the wheel *C*. When the connection is (*A e*), (*E B*), (*E f*), (*C*), then the wheel *C* turns four times for every revolution of *A*. When the connection, however, is (*A*), (*D d*), (*B*), (*F f*), (*C*), then the wheels *A* and *C* move in unison.

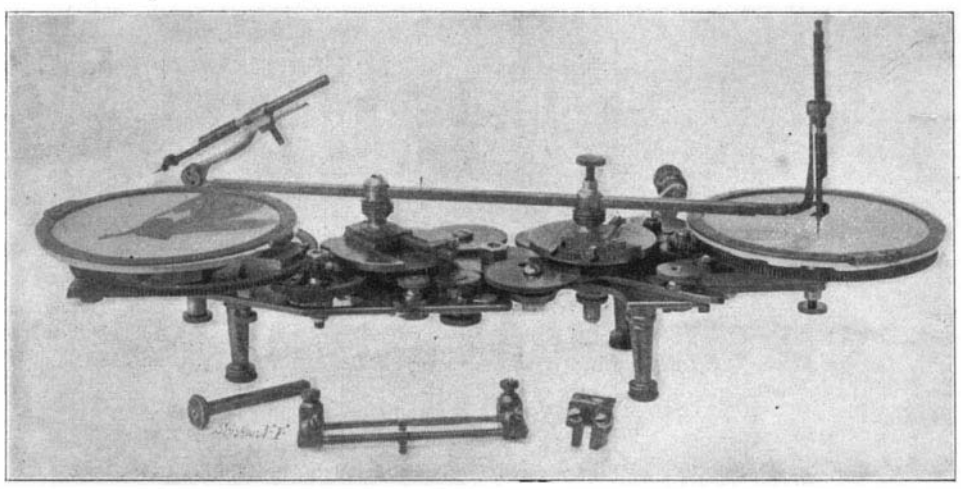
On the wheels *A* and *C* disks are fixed having eccentric slides moved by screws. Short studs are fixed on these slides, which studs are bored with taper sockets, and carry at their upper ends short screws. In the sockets, pen-heads are mounted to turn freely. The heads are pierced with square holes, through which a square pen-rod passes. When set as indicated in the perspective view, the pen will repeat over the same path. By loosening the fixing screw, the rod can be moved endwise and again fixed, so that the pen will describe a parallel figure. A spiral character can be given to any curve by the appliance which is shown attached in the top plan view and detached in the perspective view. A slotted block, also shown, fits either pen head. When the spiral frame is set in position, the slotted block detains from traversing a wheel driven by the worm on the pen-head socket, but leaves it free to turn on the screw fixed in the frame. Consequently the frame, and with it the pen-rod, traverses, making the figure continuously larger or smaller. Lines can be drawn on an elliptical path by an ellipse chuck under the left-hand disk. By varying the eccentricities of the pen-heads on the wheels *A* and *C*, the relative velocities, or the position of the pen on paper, any number of different kinds of figures can be automatically traced.

Within the range of this instrument are all the figures of a one-part geometric chuck, and others quite beyond the scope of that instrument in its more complicated forms.

The campylograph, made with a view to easy portability, is very small. The train wheels are of 100 diameter pitch, and the larger 48 diameter pitch, as are several pinions used to change the relative velocity of these wheels.



A PLAN VIEW OF THE CAMPYLOGRAPH.

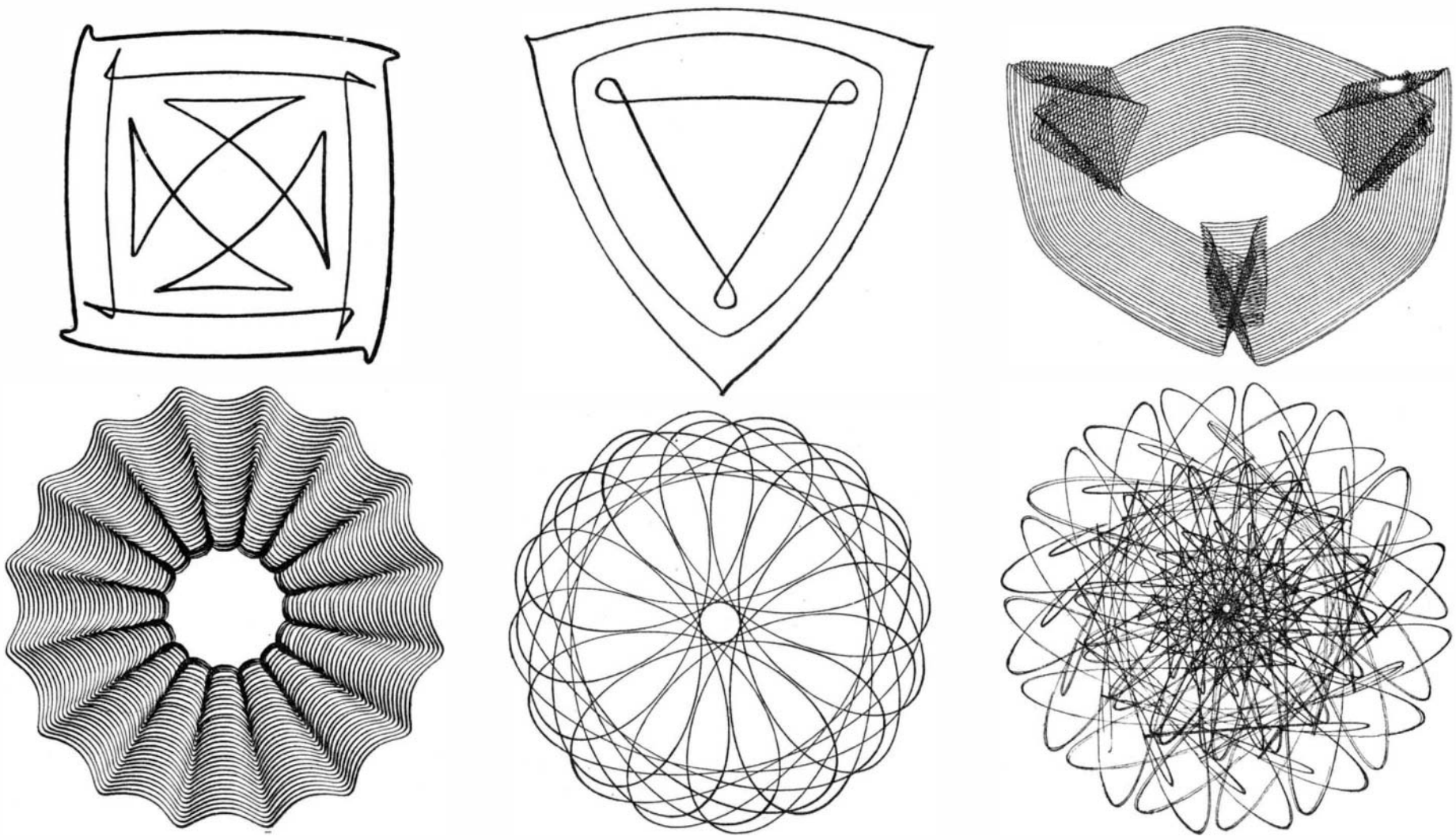


A PERSPECTIVE VIEW OF THE CAMPYLOGRAPH.

The Wireless Congress.

The Wireless Congress at Berlin, the result of an invitation extended by Germany last year with the avowed purpose of agreeing on international regulations to control the operation of wireless telegraphy systems, and to prevent any one system from getting a monopoly and rendering the employment of other systems impossible, was opened on August 6. The congress does not contemplate the adoption of any binding agreements between the powers, but intends simply to institute a preliminary discussion for the purpose of clearing up the situation for further action. A future congress may, perhaps, be convened, clothed with treaty-making powers.

The number of employes of the railways of the United States at the close of last year was 1,189,315, an increase for the year of 118,146.



GEOMETRIC FIGURES AUTOMATICALLY DESCRIBED BY THE CAMPYLOGRAPH.